

Mar 2015 SW Climate Podcast

Winter Weather Summary, Polar Opposites & El Niño Finally Arrives

In the March Southwest Climate Podcast, Zack Guido is back from his world travels (for work!) and joins Mike Crimmins to discuss SW climate, including winter precipitation, snowpack, and temperature reports so far. They also dive into the "warm in the west, cold in the east" pattern, and talk jetstream, polar vortex, and digging troughs as it pertains to SW weather patterns. Next up is the (finally arriving!) El Niño, which is a bit late, and a bit weak, but there are interesting aspects of this year to consider looking into the next year, especially the persistent ridge that has helped drive the patterns of the past few months. Finally they wrap up by looking into next year regarding what's left of winter, and what 2015 may have in store.

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Zack: Welcome to all those tuning in again to The Southwest Climate Podcast on March 6th. As always I am here with Mike Crimmins.

Mike: Welcome back Zack! He went around the world like three times. 00:15

Zack: But I am happy to be back thinking about climate and weather here in the Southwest because I think I missed quite a bit of action. 00:29

Mike: So were you checking the weather every day? 00:32

Zack: Occasionally, but I didn't pay attention too much to the daily fluctuations. Recently we have finally merged into El Niño. 00:49

Mike: Finally! 00:50

Zack: This made you correct I think. Belatedly correct. So that is the newest news. Although it isn't really news because people are calling this the No Niño even though we are officially now in El Niño conditions. 01:12

Mike: It is like the last dance of the night and El Niño decides to ask the atmosphere to dance and there you go. 01:19

Zack: So we will talk about that - some of its implications and where El Niño will be going this summer and into next winter. We will look out a year in advance. But first lets give a recap of where we are and how we got here. In terms of precipitation, which is what most people care about in the winter, December was quite wet for California. The only month that California has really experienced wet conditions over across much of its area. Arizona had spotty above average

conditions in Tucson specifically or around Tucson and in the Four Corners region, which included New Mexico. Elsewhere it was near average or slightly below average. Fast forward a month to January and California becomes bone dry, particularly in the Northern half of California. Southern Arizona gets above average precipitation. As much as 200%-300%. The Four Corners still does well and a lot of New Mexico is above average. Fast-forward to February and California for the most part is still dry, although not bone dry except for southern portions. Southern Arizona has been virtually precipitation-free; it has been much below average. The Four Corners have still done well. According to the maps I am looking at now, which there aren't many stations up there so there is some caution. The Four Corners region and New Mexico have pretty well December, January and February. Again New Mexico in February saw a lot of its region having above average precipitation. That being said, the snow pack conditions have not reflected above average precipitation. 03:32

Mike: That is the story across the West this winter. If you look at the entire western U.S., you see patterns of above average to above average precipitation. I am talking from the Pacific Northwest all the way down to us. If you toggle your map from how much precip has fallen to how much snow has fallen, the big story in the Northwest is that they are coming in at near average precipitation with almost zero snow pack. We have a fairly similar problem in the far southwest; thankfully Colorado and Utah have been able to throw up some of that precipitation in the form of snow. Which is not been the case across most of the West. 04:12

Zack: So the snow pack conditions as of today, March 6th for Arizona with the exception of Flagstaff, which as really been boosted from one storm last week. But the Gila and Salt and other basins are much below 50 percent of average. Southern New Mexico's basins are also all below 50 percent of average. California is in a horrible state. The drought in California, which has been a big topic, even though December with the atmospheric river that soaked much of California, that has been it. 05:03

Mike: That was a warm storm and any storm they have had subsequently has been a warm storm. They would get precip that would come in but they would not be able to build a snowpack along the Sierra. 05:18

Zack: So the Northern Sierra is around 15 percent of average. The central Sierra is around 20 percent of average and the Southern Sierra is around 20 percent of average. Okay Mike so weather wise, how did we unfold? 05:39

Mike: Before we should move into that, we should talk about the temperatures. We saw in the Tucson Nation Weather service's national report that was published a few days ago, this December, January and February period was the warmest on record for Tucson. If you look at some of the climate maps on here much of Arizona, California and Nevada have experienced with either top couple year records or the warmest winter on record. If you go to New Mexico it actually cools off to near average if you get to the Eastern part of the state, which we have seen this in the last couple of years with us basically stuck underneath this ridge of high pressure. 06:34

Zack: Let me put some numbers to that. For February, the state wide average for Arizona is the warmest on record. 121 years for us. California, warmest on record. Nevada, 2nd warmest. Utah, warmest. Then both Colorado and New Mexico come in at 108 out of 121. 06:57

Mike: If you look down sub regionally, if you were on the east side of the continental divide, you got a couple of these back door cold polar air. This air made it all the way to the front range of the Rockies and was able to pool and park there. That was the dividing line right there, the topography deciding if you were going to come in with a normal winter or if you are on the west side of the divide you are going to be in the heat and drought like the rest of us. 07:26

Zack: So basically west of the Rockies, no state for the December, January, February average has experience temperatures less than 109th out of 121. 07:42

Mike: All top 10 percent warmest years. 07:48

Zack: If you look at the East, it is a different story. At least the 2nd if not 3rd year in a row that I remember where we had distinct contrast between the West and the East. Polar opposites. 08:00

Mike: This pattern has been with us enough over the last couple of years and to my knowledge it is a new term, Warm West Cold East. It is not very imaginative and I don't think it even makes a terribly good acronym, but it is the jet stream. We could go back over our notes from a year ago when we were trying to dissect last winter and it looks almost exactly the same. I know some of us have family back East; I assured my family that last winter was the worst winter they would ever see. And this one topped that one which is hard to do. So again think of the jet stream pattern, that high-speed river of air about the level in the atmosphere you fly your airplanes at when we are going back and forth across the U.S. And if that jet stream is budging towards the north, south of the jet stream is going to be warm air, what we call a ridge and it will be under high pressure. If it is bowing to the south, you are going to have that cold air north of the jet stream. So you can envision a big sort of x on its side across the United States and we have been underneath the ridge with the jet stream to the north. Where is where all of the storms go, then to the Eastern U.S. and it breaks right through the northern Great Plains. The whole idea with that the lobes of the polar vortex pushing down across the Eastern U.S. 09:57

Zack: So that relates to the low snow pack conditions but we have also had a lot of precip. Depending on where you are. It is not just that you are getting warm air; it is that you are drawing in warm water from the subtropics, more or less? 10:22

Mike: Yeah and a lot of the storms that we have seen this year are what we call digging troughs. They are little waves of energy that are riding up and over the ridge in the West and as they come down on the "P" side of that ridge, they form little waves and break off into low-pressure systems. In the Southwest we just happen to be in a really good spot to receive some of that energy and when they are able to break off they kind of come right down to Arizona. We have also had a lot of moisture available to us from the East Pacific that we haven't really seen in the last 10 years. So it is that combination of these digging troughs, these little closed lobes that will come down here, pick up some moisture and put down some precip. So you can imagine then that Arizona and New Mexico can kind of benefit from these and you can also see how much of California wouldn't receive anything from a situation like that. And the big important part of that too is in that situation, those are not cold storms. They do not have any cold air to work with. 11:40

Zack: That means that the elevation that snow falls is super high. So then the question is, what is

the relation with El Niño? The back-story on this is we have been predicting, along with NOAA climate center that El Niño will materialize. Well it has sort of been present for a while and now they have officially said that okay it is because some index has been met. But it is weak. It is hovering around the threshold around what one would consider and El Niño. Do we care? 12:26

Mike: I care just for vindication so that the fact that we have been saying El Niño was going to show up every month for I think 12 months now, we can at least put that in the win column for us but other than that is has no real practical implications for us down here. 12:43

Zack: So this is a quote from NOAA yesterday. It says, "The long anticipated El Niño has finally arrived. Due to the weak strength of the El Niño, widespread or significant global weather pattern impacts are not anticipated. However, certain impacts associated with El Niño may appear this spring in parts of the Northern hemisphere such as wetter than normal conditions along the U.S. Golf Coast. I am not sure that implicates us here. A question that I received was that some people were wondering that lived in Tucson, we have experienced above average precip in Tucson, so is this a signal of El Niño? 13:20

Mike: I don't think so. So the overall jet stream pattern for the winter has been unusual. Is that jet stream pattern what you expect to see with an El Niño? No, not really. El Niño is not an individual weather event. You know how it drives us nuts when people say "it monsooned at my house last night!" It is kind of the same way if we say, "man we got El Niñoed last week." El Niño is really representing a shift in the climate system towards a stacking up of a certain type of weather pattern. We have seen everything this winter. We have seen some wet storms but it has not been in the sort of typical way you would see things stack up. Have there been flavors of El Niño from time to time? Yeah. Has it looked like La Nina for periods? Yeah, that as well. 14:48

Zack: Does the ridging have any relation to the sort of tropical Pacific Ocean? 14:56

Mike: It does. Some emerging discussion in the climate community, there is this idea that when you have lots and lots of thunderstorm and typhoon activity in the far western Pacific, that it will create a jet stream pattern like we have seen over the last couple of years. Also it is linked to, it is typically the way the Pacific looks before it is about to move into a full El Niño. So there is a couple of things there that suggests that we have been moving in an El Niño like direction for a couple of years now. And the jet stream pattern has been foreshadowing that we were going to do that as well. What that jet stream pattern looks like if you look back through the historical records is very very strong ridge of high pressure across the Western U.S. and a trough across the East. So they call this an ENSO precursor type pattern. Again it is still fresh in the literature and is going to need to be sort of poked at but it kind of fits the bill. We have been trying to do El Niño. This ridge is very persistent, it has been unusual. 16:27

Zack: So with that insinuate though, if it is a precursor, if El Niño actually materialized then that pattern would break down? 16:35

Mike: Yes and that was where I think we have been talking about for a year now - think back to the forecast. The idea that we were moving towards an El Niño. That pattern should have gone away. You couldn't have had...and think about the simple mechanism, if you have a lot of tropical convection in the far Western Pacific and it moves towards the Central Pacific, which it does in an

El Niño and which is why we hadn't declared El Niño. It hasn't moved. The West Pacific has been very active and the Central Pacific has been very quiet. You put all of these things together approximately...the jet stream pattern has been consistent. 17:26

Zack: And what it would take to move is a weakening of the easterlies. 17:29

Mike: Exactly, you need the weakening of the easterlies and then the tropical convection sort of follow the warm water to that point. What we also haven't seen a lot of indices, is when that tropical convection sort of moves away and because it follows that warm water, there should be a cooling in the far west pacific and also a decrease in that convection. So if you think about that, the whole jet stream pattern is going to reorganize with that new area of convection, which would give us a more typical El Niño signal. Which would have been a strong subtropical jet, no ridge, really leaning towards that parade of storms through Arizona and California. We didn't really have that this year. 18:15

Zack: Because that focal point of convection in the Western Pacific hasn't moved east, we have been in this persistent ridge atmospheric response. 18:32

Mike: If you look at the last couple of years it was more persistent. This year that convection was sort of moving around a bit but if you look at the averages for the whole season, it was much more active in the West Pacific than in the East. That is a further indication that El Niño was never in control. 18:56

Zack: So I have heard talk of this El Niño being unlike others we have seen in the past. But we have also seen that this persistent ridging has been present the last couple of winters. So what makes this tropical flavor different? 19:18

Mike: Again I don't know. You also have to think here too that, our historical record and our ledger of El Niño is not very long. We look for analogs and we don't have many to look from. We are building each year and so we have got realistically 10,000 years of El Niño that have occurred but we only have data on a handful of them. To me it has been exciting; it has been interesting to watch. Again what we were looking at was sea surface temperatures, they indeed did warm up in the East Pacific but they didn't cool down in the West. So the ocean gave you two things at once. It should have shifted away from having warm water in the West and the Eastern. They were like lets have warm water everywhere. That was unusual. 20:24

Zack: So the bleeding edge in addition to what you are talking about now because these are relatively new scientific papers that are coming out that are looking at the ENSO precursor and so the other winter phenomenon that has gotten a lot of play in recent years is what is going on in the arctic. How are these things combining this year? 20:47

Mike: Exactly and it seems to me that every paper I read, I get a bit more confused. Like what are all of the moving parts and pieces and the simple isolating a single mechanism is not working. These interplays at different time scales, every year we get a slightly different flavor so it gives you some reinforcement of a mechanism but then it cancels out two other mechanisms that you thought were actually working together. This year was interesting, the Arctic oscillation has actually been very positive. Probably because of the way the index is actually calculated. 21:26

Zack: So for the listeners, that positive would otherwise suggest warmer conditions. Not allowing that cold air to slosh east. 21:38

Mike: So it wasn't a very good diagnostic and it isn't predictable anyways even if you look back at the winter and you think it doesn't work with the way you thought last year...I was even under this impression that we need to watch the AO and we will have a good picture of what the pattern will be and that is not the case. 22:06

Zack: It is worth pointing out that the Arctic Oscillation, that index has a time scale that changes over days to weeks. It is high frequency. 22:19

Mike: Very low predictability, very volatile. But still useful when you look back over a couple of months, can it tell you anything about what was going on. It is kind of an interesting year where if you just looked at the indices, one of your El Niño indices was like border line to even moderate and you AO was positive. If you had no other information that would suggest that California was wet and the East was warm. Those are completely wrong. 22:48

Zack: But I think it brings up a good point because we do know that the tropical Pacific Ocean is the dominant player in this. To the point where if you have a really strong signal there, which we did, then you have more confidence in the weather response. But when it is on sort of the middle ground like it was this year, other things come into play. 23:17

Mike: Even the index...the sea surface temperatures by itself were not enough to tell us what was going on. We know that but it sure is helpful to hang your hat on a single index. Some years it has nailed it. The big El Niños of the past, everything was very clear. This year has not been very descriptive. 23:49

Zack: Yeah and we don't have the numbers. Like you were mentioning before, if we had a larger sampling size of weak and moderate and strong El Niños it would be much more robust to do statistics. I have also looked at some of the model plumes and saw that ENSO or above average sea surface temperatures are forecasted to persist. Some models are predicting it into next winter, any thoughts? 24:33

Mike: It is far out, we are right back to where we started a year ago when we saw the monster Kelvin wave come across that slug of warm water that was moving across so it does seem like at some point. Again, maybe because the atmosphere is starting to pay a bit more attention to the ocean patterns now, too late in the night, maybe this is where we are sort of leaning here. The important thing to note is that this is a really hard time of the year for ENSO models to look forward; it is the spring predictability barrier. They run into some constructive interference with just the seasonal cycle sort of changing. So their confidence is quite a bit lower this time of year. Again this idea of ENSO precursor, the idea that we haven't quite done it yet, there is another Kelvin wave that is moving across the Pacific right now, those are all things that would suggest we aren't quite done with this one. So yeah I guess we will see. 25:43

Zack: What we are nearing the end of though is our winter precipitation. We have a month left of potential storms that can help boost the snowpack conditions and provide the water for our

reservoirs, then April, May, June, we are looking towards the monsoon again already. 26:07

Mike: I think our chances are pretty slim for making up any snowpack at this point. That is because of a couple things, the access to cold air into cold storms has almost been nonexistent, and I just don't see that changing. 26:28

Zack: In terms of the stream flow forecast and I unfortunately don't have the March 1 report. So I am looking at old ones so keep that in mind. But the February one doesn't paint a good picture for the Colorado River. Stream flow forecasts are below 70 percent of average. That is not good news for the basins that are already close to those key thresholds that will instigate some conservation measures. The Rio Grande is also having low forecasts. Those numbers may change a little bit with the recent storm in early March but probably not much. 27:29

Mike: I think April 1st is that magic time stamp; there will not be a lot of change past that point. 27:48

Zack: That sort of optimism with El Niño looking so favorable for looking at worst a moderate event. Some people were even thinking it was going to be strong event. Anything else? 28:48

Mike: I am still holding out for 1 or 2 storms in Arizona in the next 6 weeks. We didn't talk about this but the East Pacific and the horseshoe of water is still there. It is what is driving this whole idea "P" index super positive and we haven't seen it in a long time. 29:24

Zack: So what does that mean? 29:26

Mike: I don't know, I think it is part of the region we have had moisture to work with. That East Pacific is still very warm it is what fueled a lot of that tropical storm activity last fall. 29:53

Zack: We touched on this in the last podcast but the length of that ridge and the warm water. Because that ridge has been present... 30:05

Mike: I read an analysis that was pointing out that this very strong ridge pattern across the west coast is unusual enough that they would have a north west wind throughout the winter time along the coast that would drive upwelling. It drives a down coastal current and that current because of the Coriolis Force diverges from the coast and causes coastal upwelling. If you don't have that for 4 years you start to see weird sea surface temperatures. If you looked at that area a year or 2 ago, that was a cold dry spot in the Pacific Ocean. Storms would run into it and get killed by it. Now it is warmer. I am curious to see if it has any impact on next fall's tropical storm season. Sea surface temps usually persist for a while. 31:35

Zack: Next podcast we can talk about the upcoming fire season. We can have some indication of the upcoming risks. 31:52

Mike: It is going to be a mixed bag for the U.S. and I think California will be in trouble again.